Instrumental Achievements

# Crystal Structure of 2,6,6-Trimethyl-3-benzoyl-4-phenyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline

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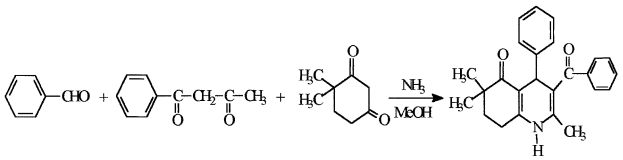
Ca ions play a vital role in the maintenance of cardiadiac contractility. Calcium channel modulators affect these ions through calcium channels. The modulators may be activators or deactivators of calcium channels. It is well known that channel activators are used for antianginal and antihypertensive purposes.[1,2] Drugs having the 1,4-dihydropridine structure have attracted attention in recent years. In these compounds, the dihydropyridine ring is essential for activity. Further, active compounds have been obtained by introducing the 1,4-dihydropyridine moiety to condenced systems, such as acridine and quinoline. Connecting various substituents to the 3- and 5-positions of the dihydropyridine ring may have an opposite effect on calcium channels, such as agonist and antagonist activity. Therefore, determination of the absolute configuration is important in such structures. The basic structure of the title compound was confirmed by IR, $^1$H-NMR, mass spectra and elemental analysis.

Equimolar amounts (0.001 mol) of 4,4-dimethyl-1,3-cyclohexanedione, benzaldehyde, benzoylacetone and 1 ml ammonia solution were refluxed in methanol for 20 h. The precipitate was crystallized from ethanol (m.p. 220 – 221˚C).



The structure was solved using MolEN.[3] The non-hydrogen atoms were refined anisotropically. Hydrogen atoms were

Table 1 Crystal data and a summary of the structure determination

| | |
|---|---|
| Formula: $C_{25}H_{25}NO_2$ | |
| Formula weight = 371.48 | |
| Crystal size = 0.4 × 0.12 × 0.54 mm | |
| Crystal system: monoclinic | |
| Space group: *Cc* | *Z* = 4 |
| *a* = 7.508(1)Å | |
| *b* = 18.543(2)Å | $\beta$ = 101.19(1)˚ |
| *c* = 14.661(0)Å | |
| *V* = 2002.3(3)Å$^3$ | |
| $D_{calc}$ = 1.23 g/cm$^3$ | |
| $\mu$ = 0.7 cm$^{-1}$ | |
| Radiation: graphite monochromated Mo $K_\alpha$ | |
| Diffractometer: Enraf-Bibuys CAD 4 | |
| Number of reflections measured: 2178 total | |
| Number of reflections used: 1583, $I > 2\sigma(I)$ | |
| Structure determination: MolEN | |
| Refinement: full-matrix least-squares | |
| Number of parameters: 254 | |
| Final value of *R*: 0.044 and *Rw*: 0.047 | |
| $(\Delta/\sigma)_{max}$ = 0.00 | |
| $(\Delta\rho)_{max}$ = 0.30(4)eÅ$^{-3}$ | |
| $(\Delta\rho)_{min}$ = –0.00(0)eÅ$^{-3}$ | |

Table 2 Atomic coordinates and equivalent isotropic thermal parameters with their esd's in parentheses

| Atom | *x* | *y* | *z* | $B_{eq}$(Å$^2$) |
|---|---|---|---|---|
| O1 | 0.4281(4) | -0.1167(2) | 0.7811(2) | 4.21(6) |
| O2 | 0.7327(4) | 0.1070(2) | 0.9079(2) | 5.08(7) |
| N | 1.0436(4) | -0.0753(2) | 0.7834(2) | 2.98(7) |
| C1 | 0.8790(0) | 0.0212(2) | 0.8330(2) | 2.55(7) |
| C2 | 0.7019(4) | -0.0111(2) | 0.7815(3) | 2.42(7) |
| C3 | 0.7243(5) | -0.0906(2) | 0.7616(3) | 2.43(7) |
| C4 | 0.8919(5) | -0.1196(2) | 0.7621(3) | 2.54(7) |
| C5 | 1.0394(5) | -0.0093(2) | 0.8237(3) | 2.67(7) |
| C6 | 1.2202(5) | 0.0237(2) | 0.8612(3) | 3.72(9) |
| C7 | 1.2018(5) | 0.1021(2) | 0.8869(3) | 3.68(9) |
| C8 | 1.0582(6) | 0.1132(3) | 0.9465(3) | 3.63(9) |
| C9 | 0.8759(5) | 0.0829(2) | 0.8936(3) | 3.29(8) |
| C10 | 0.6261(5) | 0.0312(2) | 0.6938(3) | 2.45(7) |
| C11 | 0.6730(5) | 0.0143(2) | 0.6099(3) | 3.04(8) |
| C12 | 0.6046(7) | 0.0535(3) | 0.5302(3) | 4.2(1) |
| C13 | 0.4864(7) | 0.1097(3) | 0.5330(4) | 4.8(1) |
| C14 | 0.4410(6) | 0.1271(3) | 0.6163(4) | 4.5(1) |
| C15 | 0.5093(6) | 0.0890(2) | 0.6957(3) | 3.59(9) |
| C16 | 0.5549(5) | -0.1334(2) | 0.7429(3) | 2.86(8) |
| C17 | 0.5288(5) | -0.1934(2) | 0.6741(3) | 2.80(8) |
| C18 | 0.4383(6) | -0.2555(2) | 0.6926(3) | 3.63(9) |
| C19 | 0.4123(6) | -0.3114(3) | 0.6299(4) | 4.6(1) |
| C20 | 0.4694(6) | -0.3057(3) | 0.5458(4) | 4.5(1) |
| C21 | 0.5522(6) | -0.2428(3) | 0.5262(3) | 3.83(9) |
| C22 | 0.5854(5) | -0.1879(2) | 0.5896(3) | 3.12(8) |
| C41 | 0.9433(6) | -0.1962(2) | 0.7495(3) | 3.50(9) |
| C81 | 1.1062(7) | 0.0723(4) | 1.0382(4) | 5.6(1) |
| C82 | 1.0388(7) | 0.1933(3) | 0.9661(4) | 5.5(1) |

$B_{eq} = (8/3)\pi^2 \sum_i \sum_j U_{ij} a_i^* a_j^* (\boldsymbol{a}_i \cdot \boldsymbol{a}_j)$.

Table 3 Selected bond length (Å) and angles (°) with their esd's in parentheses

| Bond length | | Bond angle | |
|---|---|---|---|
| C1 - C2 | 1.519(4) | C1 - C2 - C3 | 111.0(3) |
| C1 - C5 | 1.357(4) | C1 - C2 - C10 | 111.3(3) |
| C1 - C9 | 1.456(5) | C3 - C2 - C10 | 112.1(3) |
| C2 - C3 | 1.519(5) | C4 - N - C5 | 122.8(3) |
| C2 - C10 | 1.519(5) | O2 - C9 - C8 | 120.4(4) |
| C3 - C4 | 1.367(5) | O2 - C9 - C1 | 121.0(3) |
| C3 - C16 | 1.479(5) | C1 - C9 - C8 | 118.4(3) |
| C5 - C6 | 1.493(5) | O1 - C16 - C17 | 118.9(3) |
| C7 - C6 | 1.515(6) | C3 - C16 - O1 | 119.5(4) |
| C7 - C8 | 1.529(7) | C3 - C16 - C17 | 121.5(4) |
| C16 - C17 | 1.489(6) | | |
| C16 - O1 | 1.234(5) | | |
| N - C5 | 1.362(5) | | |
| N - C4 | 1.391(5) | | |
| O2 - C9 | 1.220(5) | | |

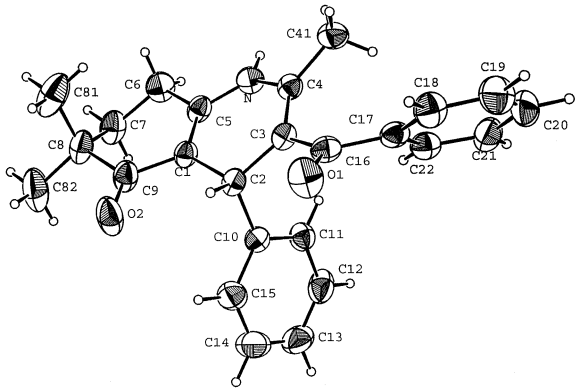



Fig. 1 ORTEP drawing of the molecule with the atomic numbering scheme. The displacement ellipsoids are drawn at the 50% probability level. The hydrogen atoms are shown as small circles with arbitrary radii.

included in the refinement, but were restrained to ride on the atom to which they were bounded, except for H2, which was determined from a difference Fourier synthesis. The crystal data and the experimental details are listed in Table 1. The structure was refined by full-matrix least squares where the function minimized was $\sum w(|F_o| - |F_c|)^2$ and the weight was defined as $4F_o^2/\sigma^2(F_o^2)$. The refined atomic parameters with equivalent isotropic temperature factors for non-hydrogen atoms are given in Table 2. The selected geometric parameters are listed in Table 3.

Figure 1 shows the configuration of a molecule which is similar to the core of (*R*,*R*)-(+)-2-methoxy-2-phenylethyl 2-methyl-4-[3,4-(methylenedioxy)phenyl]-5-oxo-1,4,5,6,7,8 hexahydroquinoline-3-carboxylate.[4] The hexahydroquinoline part of the molecule is not planar. The dihydropyridine ring is in the boat conformation. On the other hand, a half-boat confirmation is seen in the cyclohexenone ring.

Both carbonyl oxygens are involved hydrogen bonds. Nitrogen is the donor to O1 of the neighboring molecule (N–O1 2.994(4)Å). C21 interacts with the carbonyl oxygen of the next molecule (C21–O2 3.478(6)Å). H13 of C13 also forms a hydrogen bond with O1 (3.636(7)Å).

## References

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